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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,882	02/21/2002	Eric Ou-Yang	AM-3467.C1	2560

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APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER	
OLSEN, ALLAN W	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 10/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/080,882	OU-YANG ET AL.	
	Examiner	Art Unit	
	Allan W. Olsen	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 February 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 February 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-6, 9, 11 and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,248,149 issued to Li et al. (hereinafter, Li).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Li teaches a method of etching a dual damascene structure. The process entails first etching a contact hole through upper and lower dielectric layers (as well as through the intervening etch stop layer). After having formed the contact hole, a trench is etched into the upper dielectric layer. During the etching of the trench, the contact hole that has been etched into the lower dielectric is exposed to the plasma conditions of trench etching step. As such the plasma that etches the trench also constitutes a post-etch treatment of the contact hole. As gases to be used for the trench etch, Li teaches using CH2F2, O2, N2, and C4F8. Li teaches that photoresist is removed during the trench/post contact hole etching step. Li teaches the performing the process with a plasma having an average electron density of $10^{11}/cm^3$. The wafers are subsequently cleaned as Li teaches that the wafer undergoes a CMP process, which

would include at least one rinsing step. See; figures 5, 6, 7, 17 and 18; column 8, lines 6-20; column 15, lines 30-36 column 17, lines 19-29; column 18, lines 5-10, 64-65.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4, 6, 9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,194,128 issued to Tao et al. (hereinafter, Tao) in view of U.S. Patent 6,036,878 (hereinafter, Collins).

Tao teaches etching a dual damascene structure wherein an upper trench structure is etched and then from the bottom of the trench a contact hole is etched down through an underlying dielectric layer. While the contact hole is being etched through the lower dielectric layer, the plasma that etches the contact hole is also in contact with the surfaces of the previously etched trench and thereby this plasma also functions as a post-etch treatment for the

trench. Tao teaches using a MERIE plasma comprising N2, O2 and CHF3 (or CFH3). Li teaches wet cleaning step following the post-trench-etch treatment.

Li does not teach using a plasma with an electron density of at least $10^{11}/cm^3$.

Collins teaches that a typical MERIE reactor operates in a density realm of between 10^{10} e^-/cm^3 and 10^{11} e^-/cm^3 and with a chamber pressure of between 25 mTorr and 100 mTorr.

It would have been obvious to one skilled in the art to use a plasma with an electron density of at least $10^{11}/cm^3$ because this represents a typical electron density for the MERIE reactor used by Tao. Furthermore, it is noted that a high plasma density is favored by a supplying a high plasma source power and a using low chamber pressure. Tao's process uses a high plasma source power (1000 -1100 W). Tao teaches using a pressure of between 25-40 mTorr, which is in the lower portion of the range of operable pressure for a MERIE reactor (column 7, lines 14-15). Therefore the Tao teaches process conditions that favor forming a plasma with a density in the upper portion 10^{10} e^-/cm^3 - 10^{11} e^-/cm^3 density range.

Claims 1-4, 6 and 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,849,639 issued to Molloy et al (hereinafter, Molloy).

Molloy teaches a post-etch treatment after openings have been etched in a dielectric layer. The method treats the substrate with a plasma generated from a mixture of O_2, N_2, and a hydrofluorocarbon. After the post-etch treatment has removed the photoresist the substrate is removed from the chamber and is cleansed with a water rinse. Molloy teaches then returning the substrate to the plasma chamber for further cleaning (removal of mobile Na^+ ions). See: abstract; column 4, line 28 – column 5, line 20.27

Molloy does not teach a using a plasma with an electron density of at least $10^{11}/cm^3$.

It would have been obvious to one skilled in the art to us a plasma with an electron density of at least $10^{11}/cm^{-3}$ because Molloy teaches using a high density plasma reactor which,

as evidenced by Li in 6,284,149 (col. 8, line 14-18), is considered in the art to be plasma with an electron density of at least 10^{11} e^-/cm^3.

Claims 1-18 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6.082,374, issued to Huffman et al. (hereinafter, Huffman).

Huffman teaches a post via etching treatment that removes photoresist. The method comprises contacting the substrate with a plasma generated from a mixture of O_2, N_2, H_2, and a fluorine source such as C_2F_6, C_3F_8, CHF_3 or CFH_3. Huffman teaches using oxygen at each step of a multi-step process. Huffman teaches using oxygen flow rates ranging from 200 sccm to 4000 sccm. These flow rate provide for the medium flow oxygen plasma and high flow oxygen plasma. A 60 second treatment using a mixture as described above is carried out after a preliminary stage involving a high flow rate (~2000 sccm) oxygen plasma which corresponds to the oxygen flushing limitation of claims 7 and 8. A third plasma step using 200-4000 sccm of oxygen (i.e. medium to high flow rate) cleans the substrate within the chamber. The substrate is cleaned further with a water rinse after being removed from the chamber. See: column 3, lines 23-43; column 4, lines 56-61; column 5, lines 11-18, 33-67; column 6, lines 1-4, 30-47.

Huffman does not teach a using a plasma with an electron density of at least $10^{11}/cm^3$. It would have been obvious to one skilled in the art to us a plasma with an electron density of at least $10^{11}/cm^{-3}$ because Huffman teaches that any plasma apparatus may be used and it is well known that a high density plasma provided advantages, such as an increase in processing rate (higher throughput) and generally wider process widows which allows for a higher degree of process control.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 703-306-9075. If attempts to

reach the examiner by telephone are unsuccessful, the examiner's supervisor, Greg Mills, can be reached on 703-308-1633.

The general fax numbers for TC1700 are 703-872-9310 (non-after finals) and 703-872-9311(after-final).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen, Ph.D.
September 30, 2003